

## **IN THE CLAIMS:**

We claim:

1. A portable system for monitoring and evaluating water quality using ventilatory behavior and body movement of an aquatic organism, comprising:
  - an exposure chamber for housing an aquatic organism;
  - a water inlet for directing water to the exposure chamber;
  - an electrode for sensing and quantifying ventilatory behavior and body movement of said aquatic organism into data and outputting said data as a behavioral signal;
  - a controller for receiving the behavioral signal and determining a plurality of ventilatory parameters based on the behavioral signal; and
  - a recirculating apparatus for recirculating water to the exposure chamber.
2. The system of Claim 1, wherein the recirculating apparatus comprises:
  - a water reservoir;
  - a water quality sensor; and
  - a pump for pumping the water from the water reservoir through the water quality sensor and into the exposure chamber.
3. The system of Claim 2, wherein the recirculating apparatus further comprises:
  - a water distribution manifold for dividing the water before it enters the exposure chamber.
4. The system of Claim 2, wherein the water quality sensor senses a characteristic of water supplied to the exposure chamber, wherein the controller is responsive to the water quality sensor by comparing the water characteristic with the corresponding behavioral signal to determine when a change in one or more of the

ventilatory parameters occurred at the approximate time that a change in water characteristic occurred.

5. The system of Claim 4, wherein the water characteristic includes dissolved oxygen level and temperature.

6. The system of Claim 2, further comprising:  
a first portable housing;  
wherein the exposure chamber, electrode, water reservoir and pump are disposed within the first housing.

7. The system of Claim 6, wherein the water quality sensor is pivotally attached to the exterior of the first housing via a calibration bracket.

8. The system of Claim 6, further comprising:  
a second portable housing in communication with the first portable housing; and  
electrical components disposed within the second housing;  
wherein the water quality sensor is pivotally attached to the exterior of the first housing and the second housing.

9. The system of Claim 1, further comprising:  
a heater/chiller unit for controlling a temperature of water being tested by the system.

10. The system of Claim 1, further comprising:  
a backup aeration device for preventing suffocation of the aquatic organism in the case of water loss from the system or electrical failure of the system.

11. The system of Claim 1, wherein the controller further determines when one or more of the parameters exceed a threshold.

12. The system of Claim 1, wherein the controller determines ventilatory frequency, average ventilatory depth, and cough rate of the organism based on the behavioral signal.

13. The system of Claim 1, further comprising:  
a water sampler responsive to the controller for automatically sampling water supplied to the exposure chamber for subsequent analysis.

14. The system of Claim 1, wherein the exposure chamber is supplied with water to be discharged into the environment, including means for directing the water into a holding tank when the controller determines that one or more of the ventilatory parameters exceed a threshold.

15. The system of Claim 1, wherein the exposure chamber includes a plurality of compartments, each of which can house an aquatic organism.

16. The system of Claim 1, wherein the aquatic organism is a fish.

17. A method of evaluating water quality comprising:  
delivering water to be evaluated to a water reservoir;  
pumping the water from the water reservoir to an exposure chamber housing at least one aquatic organism;  
measuring electrical signals generated by the at least one aquatic organism;  
determining a plurality of ventilatory parameters of the aquatic organism based on the electrical signals;  
draining the water in the exposure chamber back into the reservoir; and  
pumping the water back into the exposure chamber.

18. The method of Claim 17, further comprising:  
pumping the water from the water reservoir through a water quality sensor  
wherein the water quality sensor detects a characteristic of the water supplied to the  
exposure chamber.
19. The method of Claim 18, further comprising:  
delivering the water to a water distribution manifold;  
wherein the exposure chamber comprises at least two chamber  
compartments, wherein each chamber compartment houses an aquatic organism, and  
wherein the water distribution manifold divides and distributes the water into each  
chamber compartment.
20. The method of Claim 19, further comprising:  
monitoring the water pressure of the water entering the water distribution  
manifold.
21. The method of Claim 18, further comprising:  
maintaining the temperature of the water being evaluated within the  
exposure chamber at a predetermined value.
22. A method of evaluating water quality comprising:  
delivering water to be evaluated to a water reservoir;  
pumping the water from the water reservoir to an exposure chamber  
housing at least one aquatic organism;  
maintaining the temperature of the water being evaluated within the  
exposure chamber at a predetermined value;  
measuring electrical signals generated by the at least one aquatic  
organism;  
determining a plurality of ventilatory parameters of the aquatic organism  
based on the electrical signals;  
draining the water in the exposure chamber back into the reservoir; and

pumping the water out of the reservoir through a source water outlet.

23. The method of Claim 22, further comprising:

pumping the water from the water reservoir through a water quality sensor wherein the water quality sensor detects a characteristic of the water supplied to the exposure chamber.

24. The method of Claim 23, further comprising:

delivering the water to a water distribution manifold;

wherein the exposure chamber comprises at least two chamber compartments, wherein each chamber compartment houses an aquatic organism, and wherein the water distribution manifold divides and distributes the water into each chamber compartment.

25. The method of Claim 24, further comprising:

monitoring the water pressure of the water entering the water distribution manifold.